

UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF MASSACHUSETTS

SINGULAR COMPUTING LLC,

Plaintiff,

v.

GOOGLE LLC,

Defendant.

Civil Action No. 1:19-cv-12551 FDS

Hon. F. Dennis Saylor IV

**DECLARATION OF ROY BANNON IN SUPPORT OF
GOOGLE’S OPPOSITION TO SINGULAR’S MOTION TO COMPEL
PRODUCTION OF SAMPLES OF THE ACCUSED PRODUCTS**

I, Roy Bannon, declare as follows:

1. I am a member of the technical staff at Google LLC (“Google”). I manage a team of hardware engineers. I have personal knowledge of the facts stated in this declaration and, if called as a witness, could and would testify to those facts.

2. Google’s Tensor Processing Units (“TPUs”) are application-specific integrated circuits developed by Google for machine learning. Google does not sell TPUs on their own or as part of other products; instead, Google makes TPUs available to internal users and external customers, who use TPUs’ capabilities for machine learning applications. External customers access the TPUs through Google’s Cloud TPU product. With Cloud TPU, customers can run their own machine-learning applications on TPU hardware hosted by Google in its datacenters.

3. I understand that certain versions of Google’s TPUs have been accused of patent infringement by Singular Computing LLC (“Singular”), and that Singular has requested sample TPU boards—which consist of four TPUs each as well as other components that connect and integrate them—so Singular can test mathematical operations on the TPU.

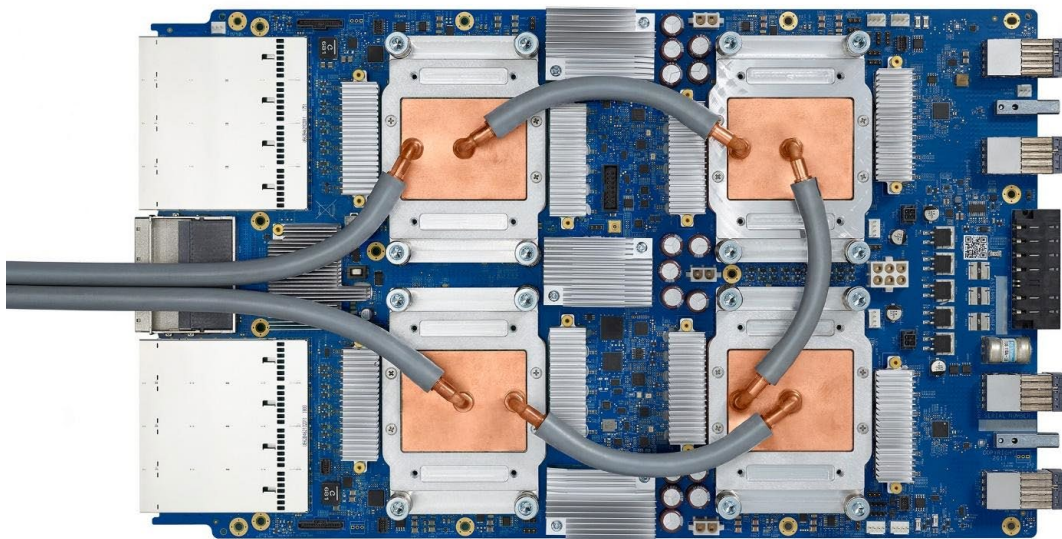
4. The physical architecture of TPU chips and boards comprises commercially sensitive, proprietary information, which Google closely guards to protect its value.

5. TPU boards have highly specialized architectural, power, and cooling requirements, without which they will not function. For example, TPU boards require over 2400 watts of power, and boards for TPUV3 must be cooled by water with precisely controlled temperature, chemical composition, and flow rate. The boards also require a dedicated, specific Google host server; they will not function with a standard server as the host. Accordingly, to the best of my knowledge, a TPU board is designed to operate in a custom server rack at a Google datacenter. At minimum, running tests on a TPU board outside of a Google datacenter would require a highly customized and unusual testbed, assuming it could be engineered at all. I am not aware of any TPU running in any facility that is not either (1) a Google datacenter, or (2) the TPUs' manufacturer facility, which runs the TPUs for testing purposes.

6. Running TPUs requires a variety of Google proprietary software, including proprietary system firmware (board control), CPU firmware (BIOS), proprietary TPU firmware, proprietary root-of-trust firmware, proprietary kernel drivers, and proprietary user space drivers that depend on a large amount of Google infrastructure libraries, as well as third-party firmware for devices such as voltage regulators and PCIe switches. Distributing this software would require, among other things, sorting out trade secret protections, licensing, and third-party agreements.

7. A private Cloud TPU account would allow a user to run mathematical tests on TPU hardware as it exists in its standard configuration in Google's datacenters.

8. Google can provide non-functional TPU boards that would look identical to the actual TPU boards. For example, a non-functional version of the TPUv3 board would appear as follows:



9. The only difference would be that the TPUs—that is, the silicon chips packaged inside a “chip package” and thus not visible—would not exist on such a sample board. To an observer, however, the sample boards would be indistinguishable from a board that actually contains TPUs.

I declare under penalty of perjury that the foregoing is true and correct. Executed on December 2, 2020, at Palo Alto, California.



ROY BANNON

CERTIFICATE OF SERVICE

I certify that this document is being filed through the Court's electronic filing system, which serves counsel for other parties who are registered participants as identified on the Notice of Electronic Filing (NEF). Any counsel for other parties who are not registered participants are being served by first class mail on the date of electronic filing.

/s/ Nathan R. Speed

Nathan R. Speed